Procedure

Preparation

1. Make one set of **Lake Sturgeon Life Cycle Cards**.
2. Refer to the **Playing Field Diagram** from the original lesson and set up the playing field as shown. Include the spawning grounds, rocks, low-head dam, downstream, lake with two token containers, upstream, low-head dam (with a waterfall), and broad jump.
3. You may want to make laminated signs for each area along the migration course to remind students what each obstacle course area represents: cobble-bottom river, sandy-bottom river, downstream, lake, upstream, low-head dam, waterfall, and fish passage.

Activity

Warm-up

1. Choose six student volunteers to stand in front of the class. Distribute one Lake Sturgeon Life Cycle Card to each. Have students hold their cards on their foreheads with the picture side facing out. Ask them to arrange themselves in order of youngest to oldest lake sturgeon life stage. When they're in the correct order, have each student read their card aloud to the class. Discuss the definition of life cycle with the students.
2. Tell students that lake sturgeon migrate to complete their life cycle. Ask students what it means to migrate.
3. Ask students to think of the types of obstacles or challenges that a fish might encounter as it travels along its migration route to spawning habitat. Answers will be general and will vary because the students don't yet have a specific type of fish or habitat to consider.
4. Tell students that they're going to travel an obstacle course to learn more about the migration and life cycle of lake sturgeon. As they play the game, ask them to think about the various food web roles that lake sturgeon play during different stages of their life cycle.

Lesson

Round One: Playing the Game

1. Explain the general set-up of the playing field to the class. Tell the students they're all lake sturgeon eggs—stuck to cobble-sized rocks in a shallow river with clear fast-running water—and that they'll try to complete their life cycles. Their job will be to migrate from the spawing area, down the stream, and into the big lake. When they reach the lake, they'll find lots of food and grow into adults. They'll then migrate upstream (the upstream area is separated from the downstream area to avoid collisions) and return to the cobble-bottom part of the river to spawn and have their own young.
2. Describe the course locations the students will visit during Round One.
   Cobble-bottomed spawning ground—This is where the game starts. Six to eight cones in river represent cobble size rocks. The

- The Playing Field Diagram found in the original Run For Your Life Cycle Lesson illustrates the set-up for each round of the game.
- Each student participates in every round. You may wish to switch the students' roles (lake sturgeon, great blue herons, anglers) in different rounds.
- You may wish to time each round and have students discuss the reasons why it takes differing amounts of time to complete each round.

lake sturgeon begin their lives as eggs, which attach themselves to the rocks. Students begin the game curled up next to the cones.
Downstream—After hatching and growing into larva, the lake sturgeon travel downstream to a sandy-bottom part of the river where the water slows down. Once the lake sturgeon become sub-adutls they migrate to the lake. **Lake**—In the lake, the lake sturgeon must move back and forth across the lake area to gather ten tokens: there is a container of tokens on each side of the lake. The tokens represent food, and players can pick up only one at a time—first from one container and then, after crossing the lake, from the other container. As it crosses the lake and returns to the first container, each lake sturgeon picks up a third token, and travels back across the lake for a fourth token and so on. When a fish has ten tokens, it has had enough food to grow into a mature adult fish, which may then migrate upstream to the cobble-bottomed river to spawn.
Upstream—The adult lake sturgeon travel upstream to the cobble-bottomed spawning ground.
Cobble-bottomed spawning ground—This round ends when all lake sturgeon return to the spawning ground.

3 Review the lake sturgeon life cycle with the students. Explain that each lake sturgeon should loudly declare the stage of their life cycle as they proceed from one stage to the next.

- As the game begins, students curl up next to rocks (cones) in the spawining ground. They should all shout, "Egg!" and touch a cone. They should continue to touch the cone while slowly counting aloud to eight (it takes approximately eight days for an embryo to hatch from an egg).
- Then they must crouch, with their hands still on the cone, and shout, "Yolk-sac larvae!" and count aloud to ten.
- Shouting, "larvae!" the students may let go of their cones and swim (crawl) around the spawning ground, pretending to float to a sandy-bottomed area of the river, while slowly counting aloud to five-months (one month, two months, three months, four months, five months).
- After counting to five months, the lake sturgeon shout, "juvenile!" and begin their journey downstream towards the lake. The juveniles will swim in the downstream section of the river counting to five years (one year, two years, three years, four years, five years).
- After they are done counting to five years the juveniles shout "Sub-adult!" and may enter the lake.
- Upon reaching the lake, and after gathering the ten tokens as instructed, the lake sturgeon shout, "Adult!" They've spent twenty to twenty-five years growing and maturing in the lake. They're ready to head upstream toward the cobble-bottomed spawning area.
- When the lake sturgeon reach the spawning, they shout, "Spawn!" They've now completed their life cycle.

During the round, stop students at different points along the migration route. Ask students to state their stage of the lake sturgeon life cycle at that point. Ask them what a lake sturgeon might eat, and what might eat them during this stage of their life cycle. What roles do they play in the food web—predator, prey, or both?

4 Using a whistle or other noisemaker, signal the students to begin Round One.
5 This round concludes when all lake sturgeon have reached the wetland spawning ground. Signal the end of Round One. Discuss with students what happened in this round. How many lake sturgeon completed their life cycle? (All of the lake sturgeon should have completed the cycle because there were no obstacles, or limiting factors, on the migration route.)

Round Two: Natural Predators as Limiting Factors

1 Follow the same directions as for Round One, but this time, add a natural predator (great blue heron) as a limiting factor for the lake sturgeon as they travel downstream.
2 Choose one student to be a great blue heron. Place them in the downstream area of the course. The predators must catch (tag) the lake sturgeon with both hands after the juvenile leaves the spawning ground and arrive in the downstream area. Tagged fish are dead and must sit out. They may become eggs again after the first successful adult lake sturgeon return to the cobbly-bottom river to spawn. The great blue heron must escort the tagged lake sturgeon to a designated area outside of the stream. (This allows some lake sturgeon to pass downstream to the lake without the great blue heron present.)
3 Can the students predict what will happen in this round?
4 Signal the students to begin the round. You may wish to continue the round, allowing the returning lake sturgeon to spawn. The students on the sidelines can become eggs again, while the surviving adults continue back downstream after they've spawned. Signal the end of the round sometime after the last surviving adult northern has returned to the spawning gronds.
5 At the end of this round, discuss with the students the number of lake sturgeon that made it back to the spawning grounds, comparing the results to Round One. Discuss why fewer adult lake sturgeon made it back to the spawning grounds in this round.

You can adjust the number of anglers and other predators according to class size.

Round Three: Anglers as Limiting Factors

1 Follow the same directions as Round Two, but this time, add anglers as a limiting factor for the lake sturgeon in the lake. (Keep the great blue heron in this round if you have enough participants.)
2 Choose one or two students to be anglers and give each a cardboard box to represent a fishing boat. With one foot in the box, anglers should shuffle along in the lake to attempt to catch (tag) lake sturgeon in the lake with both hands. Tagged fish must sit out. The anglers then escort the tagged lake sturgeon to a designated area outside of the lake. Again, this allows some lake sturgeon to pass freely while anglers lead their catches to the designated area.
3 At the end of this round, discuss with the students the number of lake sturgeon that made it back to the spawning grounds in Round Three, comparing the results to the previous rounds. Discuss why

a different number of lake sturgeon may have made it back to the wetland this time.

Round Four: Low-head Dam as a Limiting Factor

1. Follow the same directions as in Round Three, but add a low-head dam as a limiting factor as lake sturgeon travel between the stream and the lake.
2. Choose two adults or tall students to be a team. Between the downstream section of the course and the lake, this team swings the jump rope, which represents a low-head dam located in the downstream area next to the lake. The students must jump rope before entering the lake, representing lake sturgeon jumping over the head of the dam and trying to clear the turbulent water below. The lake sturgeon must not go around the jump rope twirlers. They may slip under the twirlers' arms, but *must not get touched by the twirlers or the rope as they do so.* They may also run underneath the twirling rope or jump it several times, if they prefer. A lake sturgeon "dies" if touched by the twirling jump rope at any time.
3. When all the lake sturgeon moving downstream have passed the dam, the rope twirlers simulating the low-head dam should move to the upstream side of the course, between the upstream area and the lake, to represent the waterfall, or jumping the head of the dam. They should place two jump ropes on the ground (see **Playing Field Diagram**) to represent the distance that lake sturgeon must jump to clear the waterfall and the dam. Be sure this jumping distance is challenging, but the students should be able to do it as a standing broad jump. The lake sturgeon must jump the entire distance of the standing broad jump to continue. If a lake sturgeon fails to make the jump, it doesn't survive the waterfall and backflow current and must sit out.
4. At the end of this round, discuss with the students the number of lake sturgeon that made it back to the spawning grounds, comparing results from the previous rounds. Discuss why there might have been a difference in the number of lake sturgeon that made it back to the spawning grounds this time.

Round Five: Fish Passage Reducing the Impact of a Limiting Factor

1. Follow the instructions for Round Four, but place a fish passage between the lake and the spawning grounds on the upstream side of the stream—to take the place of the upstream waterfall over the lowhead dam. The lowhead dam on the downstream side of the course will still remain.
2. Any lake sturgeon that "dies" during in this round will immediately become part of the fish passage. The great blue herons and anglers will escort the tagged lake sturgeon to the fish passage. This removes the predators from the field regularly, providing a more realistic survival ratio.
3. The students depicting the fish passage should kneel on the ground in a line facing the wetland, an arm's-length apart, and in single file.

If you wish, use cones rather than students to represent the fish passage. The expired lake sturgeon can be escorted to the sideline area.

The adult lake sturgeon must weave through the line of students forming the fish passage in order to enter the spawning grounds. This enforced trip through the fish passage demonstrates how restricted and tedious an upstream journey through a fish passage can be. Within the fish passage, the predators may not tag the lake sturgeon.

4. At the end of this round, discuss with the students the number of lake sturgeon that made it back to the spawning grounds, comparing the number to previous rounds. Discuss why there might have been a difference in the number of lake sturgeon that made it back to the spawning grounds this time.

Round Six: An Invasive Species as a Limiting Factor

1. Follow the instructions for Round Five, but this time, an invasive species is introduced into the spawning grounds.
2. Choose two students to be round gobies, a non-native invasive fish found in the Great Lakes that eat fish eggs. These students will crawl through the spawning grounds and "eat" the sturgeon eggs. When the goby eats an egg it brings the egg to a designated area outside of the spawning grounds and the egg must sit out or become part of the fish passage for the duration of the game.
3. At the end of this round, discuss with the students the number of lake sturgeon that made it back to the spawning grounds, comparing the number to previous rounds. Discuss why there might have been a difference in the number of lake sturgeon that made it back to the spawning grounds this time.

Wrap-up

1. Engage the students in a discussion of the following questions:
   - Do all lake sturgeon eggs become adults?
   - What were the limiting factors in the game? Can you think of other limiting factors?
   - What was the most challenging part of the migration course?
   - Where were the most lake sturgeon caught? Which parts of the route were less difficult?
   - What would happen if all the juveniles made the journey successfully?
   - What seemed realistic about this game? What didn't seem realistic?
   - Name the three habitats though which lake sturgeon must migrate to complete its life cycle.
   - Do lake sturgeon have more than one role in a food web? At what stages of its life cycle is it a predator? At what stages is it prey for other predators?
   - Why do adult female lake sturgeon produce so many eggs?
2. Have students draw the limiting factors they encountered during the game.
3. Encourage the students to form the generalization that all animals, not just lake sturgeon, are affected by limiting factors in their environments.

Assessment Options

1. Have students draw a picture of a lake sturgeon's migratory route, including the following:
   - major stages of the life cycle (egg, sac larva, larva, juvenile, sub-adult, adult)
   - the locations to which lake sturgeon travel (cobble-bottomed spawning ground, sandy bottomed area in a river, river, lake)
   - some natural limiting factors (such as drought, floods and other weather conditions, predators, food shortages, inadequate cover, crowding, and disease)
   - at least three human-induced limiting factors (such as pollution, anglers, changing water levels in rivers for agriculture or hydro-eliectric use, introducing non-native invasive species, and accidental chemical or waste spills)
2. Have students draw or make a model of a food web that includes lake sturgeon eggs, sac larva, larva, juveniles, sub-adults, and adults. You could also have them use a computer graphics program to make their food web.
3. Have students compose a ballad (narrative song or poem, especially a traditional one telling a story in a number of short, regular stanzas, often with a refrain) that depicts the life cycle of lake sturgeon and the challenges or limiting factors they face as they migrate to complete their life cycle.